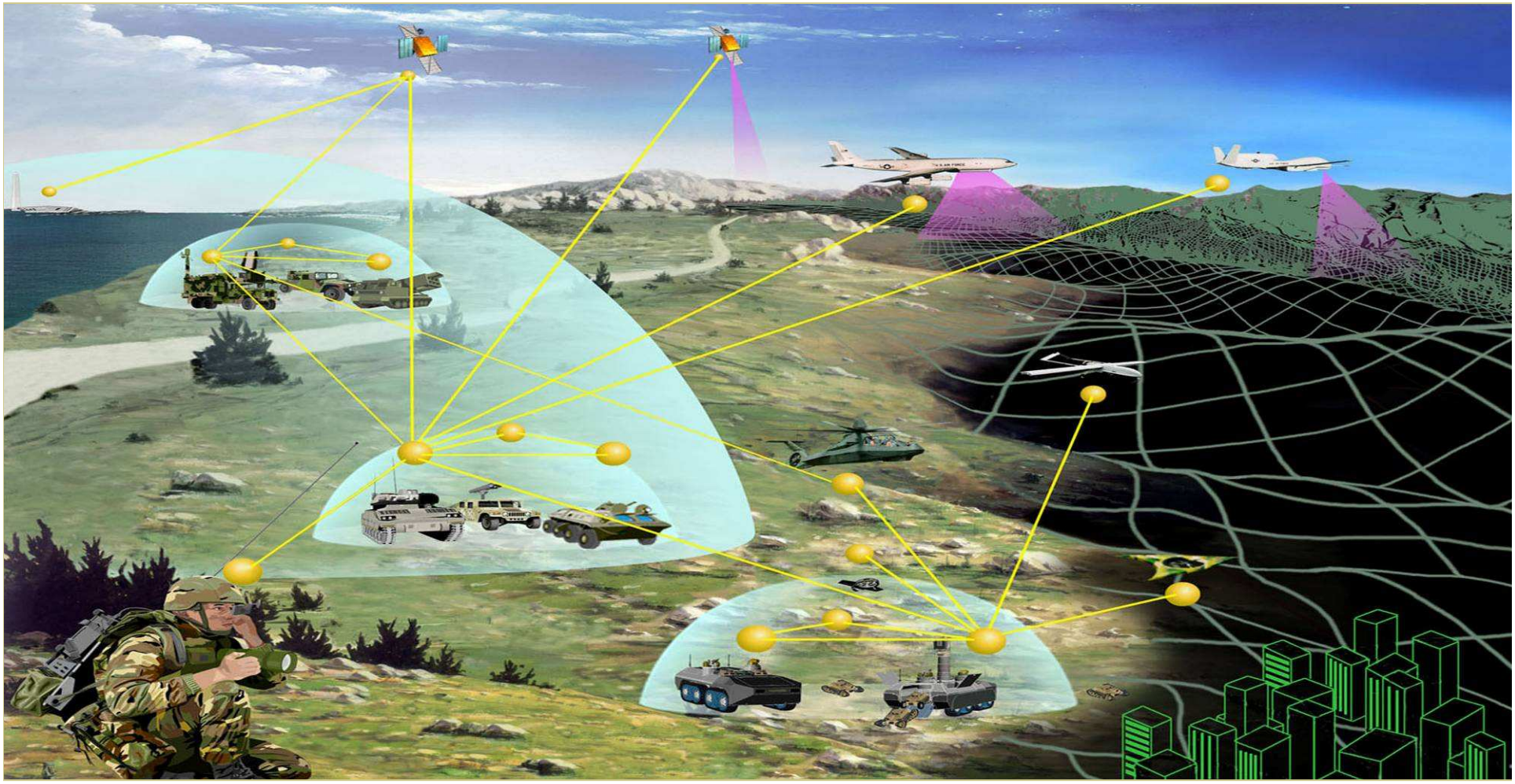
Battlespace Terrain Reasoning and Awareness- Battle Command (BTRA-BC)



A Geo-environmental Response to Net-Centric and Distributed Operations

Outline

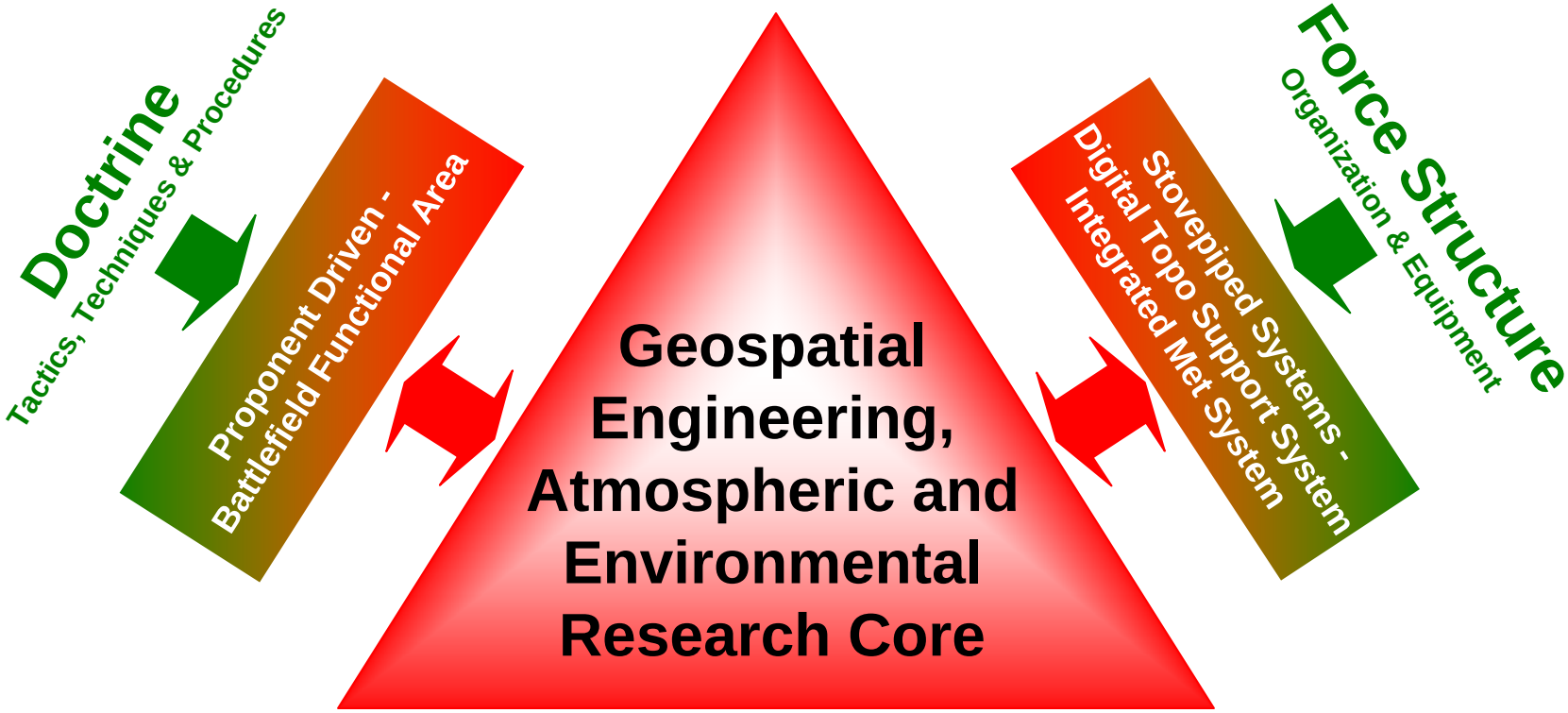
- **Setting a perspective**
  - Programs of Record (POR) evolution and Requirements
  - MDMP Process
  - Net Centricity

BTRA-BC Program
Mission and Assumptions

- ***Functional Mission:*** **To increase the effectiveness and agility of *Battle Command (BC)* and the *Military Decision Making Process (MDMP)* …..through the application of geo-environmental data, information/knowledge …. across the greatest extent possible, across of the force**
  - Battlefield Operating System of Systems….. Battle Command
  - Decision Making Process….. MDMP
  - Distributed, networked force ….. comprised of ground and air assets

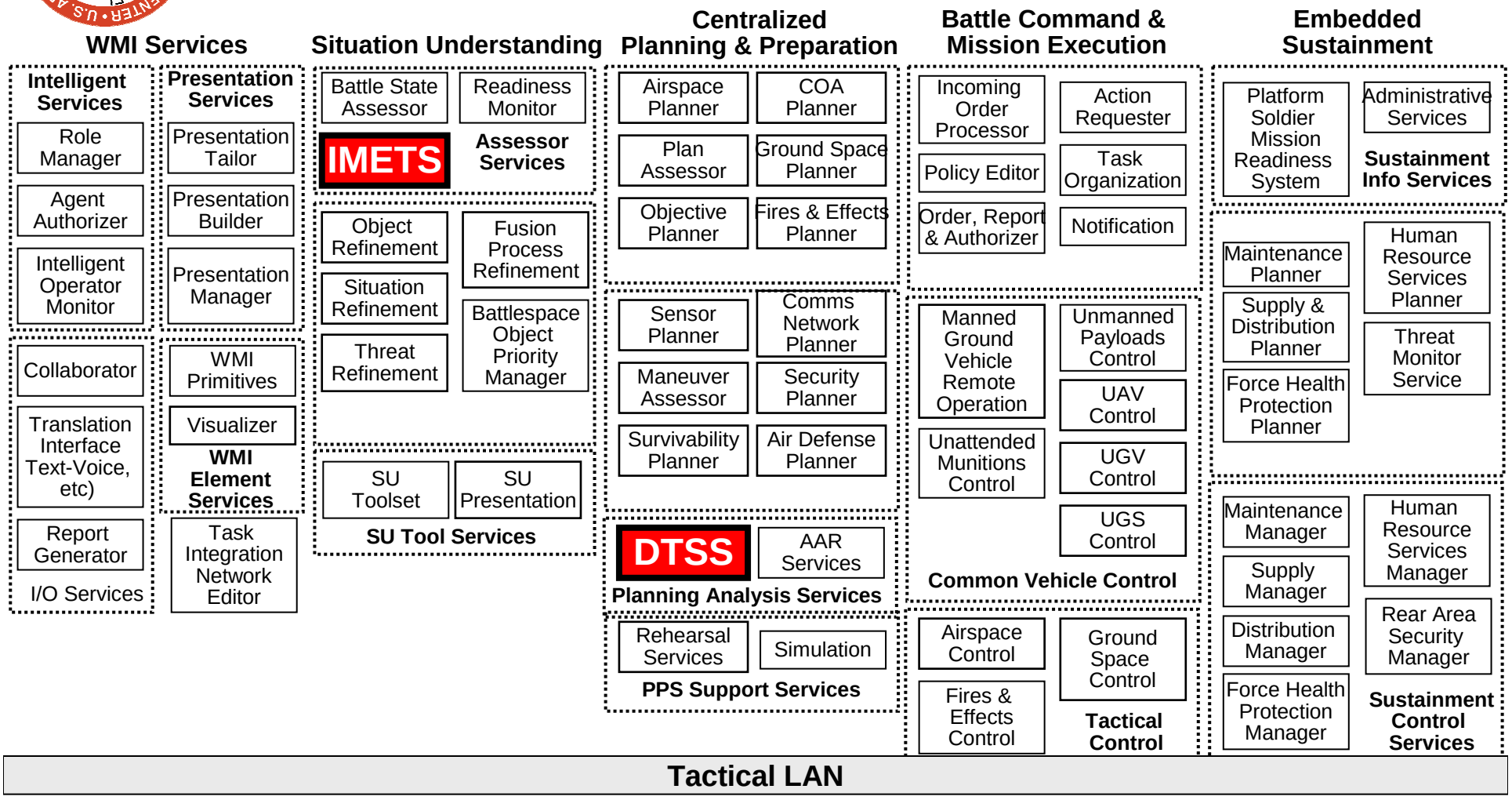
- **Assumptions: Underpinning such an ambitious statement**
  - Terrain and weather are fundamental, ubiquitous enabler/constraint to:
    - Combatant and non-combatant behavior (tactics)
    - Force, system and soldier performance
  - Military operations and behaviors are not random (strategy and tactics)
    - Basis for terrain and weather *relationships* among missions, tactics, tasks and expected performance
  - Inter-relationships provide a 1st principle *enabler* in BC and MDMP

Integration of Physical and Military Sciences (1990 – 2002)



Battle Command - BOS Specific

(Geospatial and Atmospheric Information and Technology)

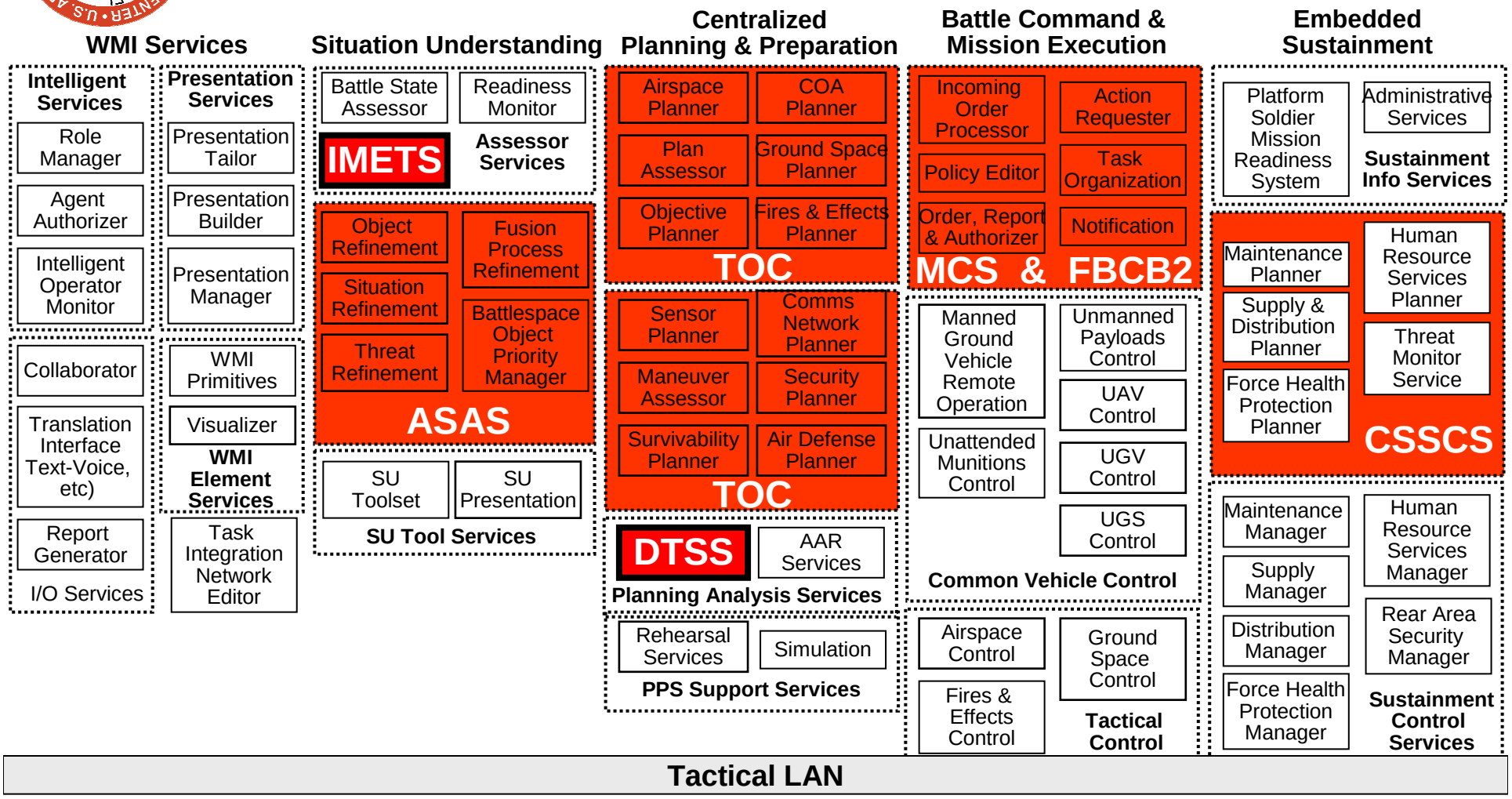


DTSS – Engineer System

IMETS – Aviation System

Battle Command - ABCS

(Geospatial and Atmospheric Information and Technology)



Notoriously Stovepiped…..Remained BOS Specific

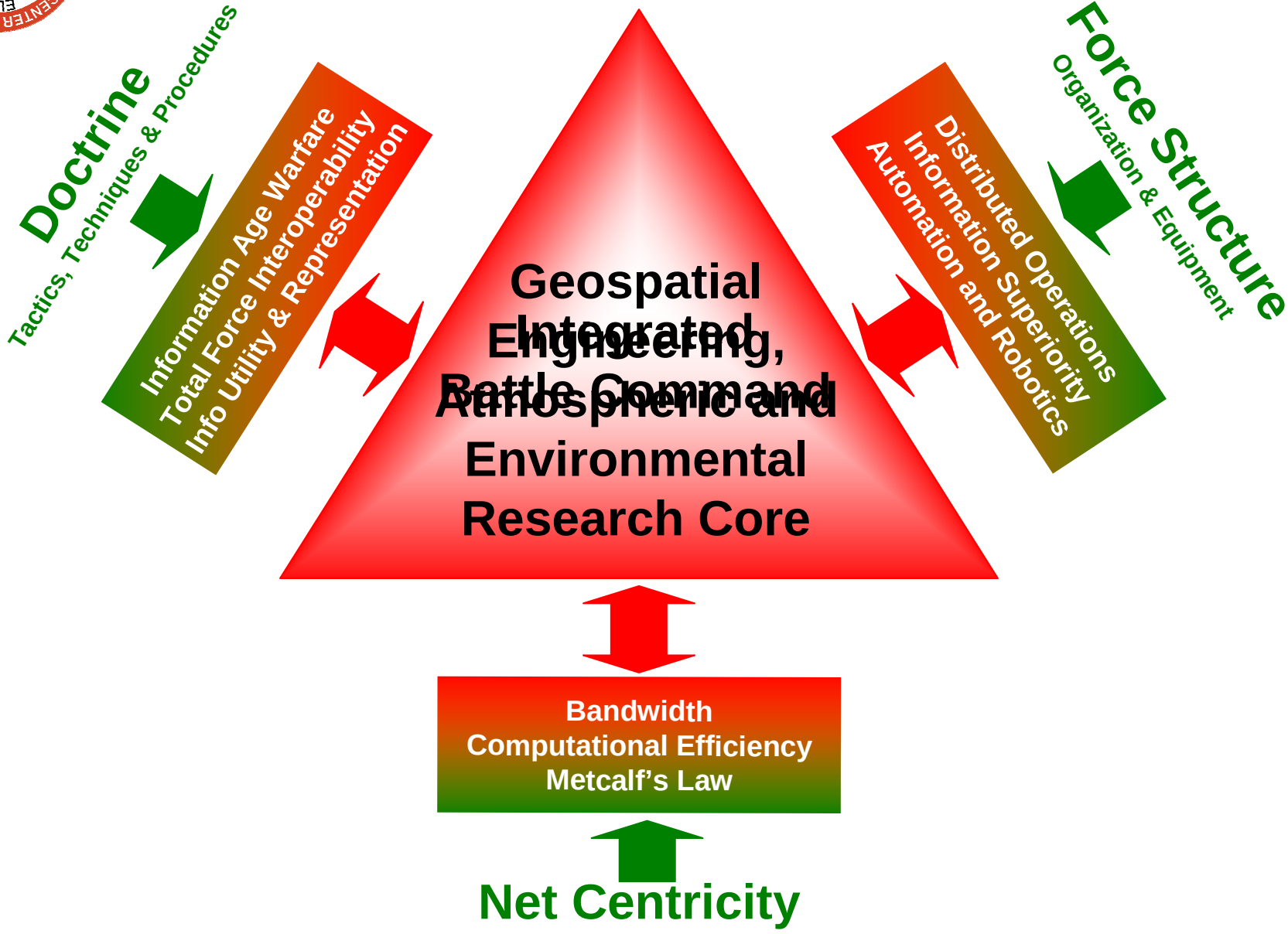
Interoperability achieved via Message and Graphics Exchange

Multiple Mapping Packages

FBCB2 Geospatial Requirement

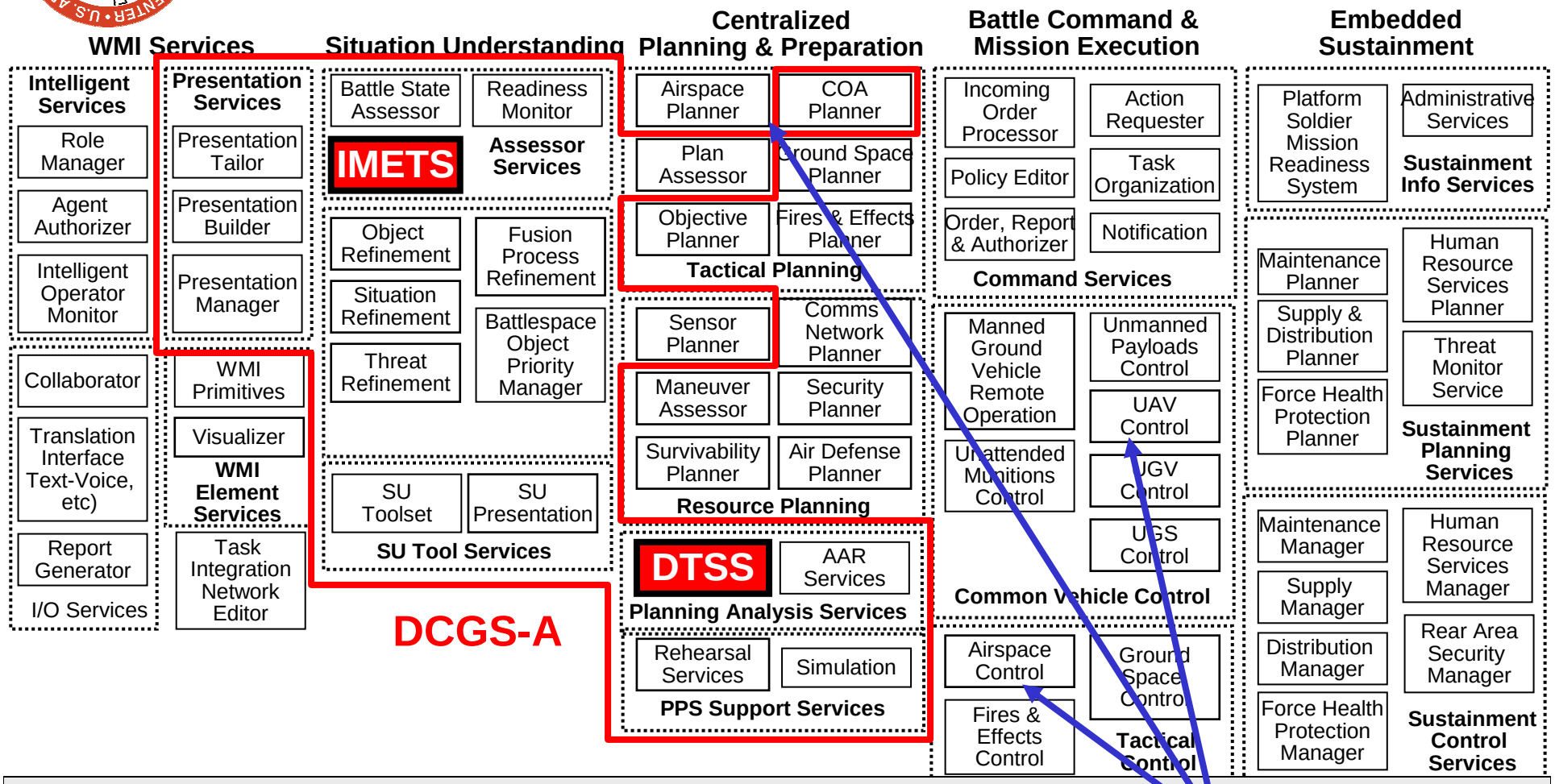
Geospatial Information and Services. The system shall accept National Imagery and Mapping Agency (NIMA) Meteorological and Oceanographic (METOC) data and standard Digital Topographic Data (DTD) in standard formats without requiring second party transformation or alteration. The system shall import and use NIMA standard DTD products (raster, vector and matrix), Digital Topographic Support System (DTSS) products and updates or field expedient products provided by higher echelon resources to generate tactical decision aids. Imagery products shall be compliant with the National Imagery Transmission Format (NITF) standard. The system shall be capable of turning geospatial features and their attributes on or off for display on the common picture. The system shall enable the user to enhance selected features/attributes with value added or updated information during operations. The system shall render map vector data on the COP using the NIMA standard terrain symbology for digital products (GEOSY - MIL PRF-89045). In addition, the system shall be able to use NIMA digital products for the development of three-dimensional terrain perspectives at appropriate resolutions/scales with the system using standardized DTD exploitation tools to generate these perspectives. To facilitate system participation in a simulated environment it is required that FBCB2 be capable of importing, displaying and using CCTT and WARSIM terrain databases.

Integration of Physical and Military Sciences (2002 – 2020)



Battle Command – Future Force

(Geospatial and Atmospheric Information and Technology)



Attempt to merge functionality….Reducing Stovepipes

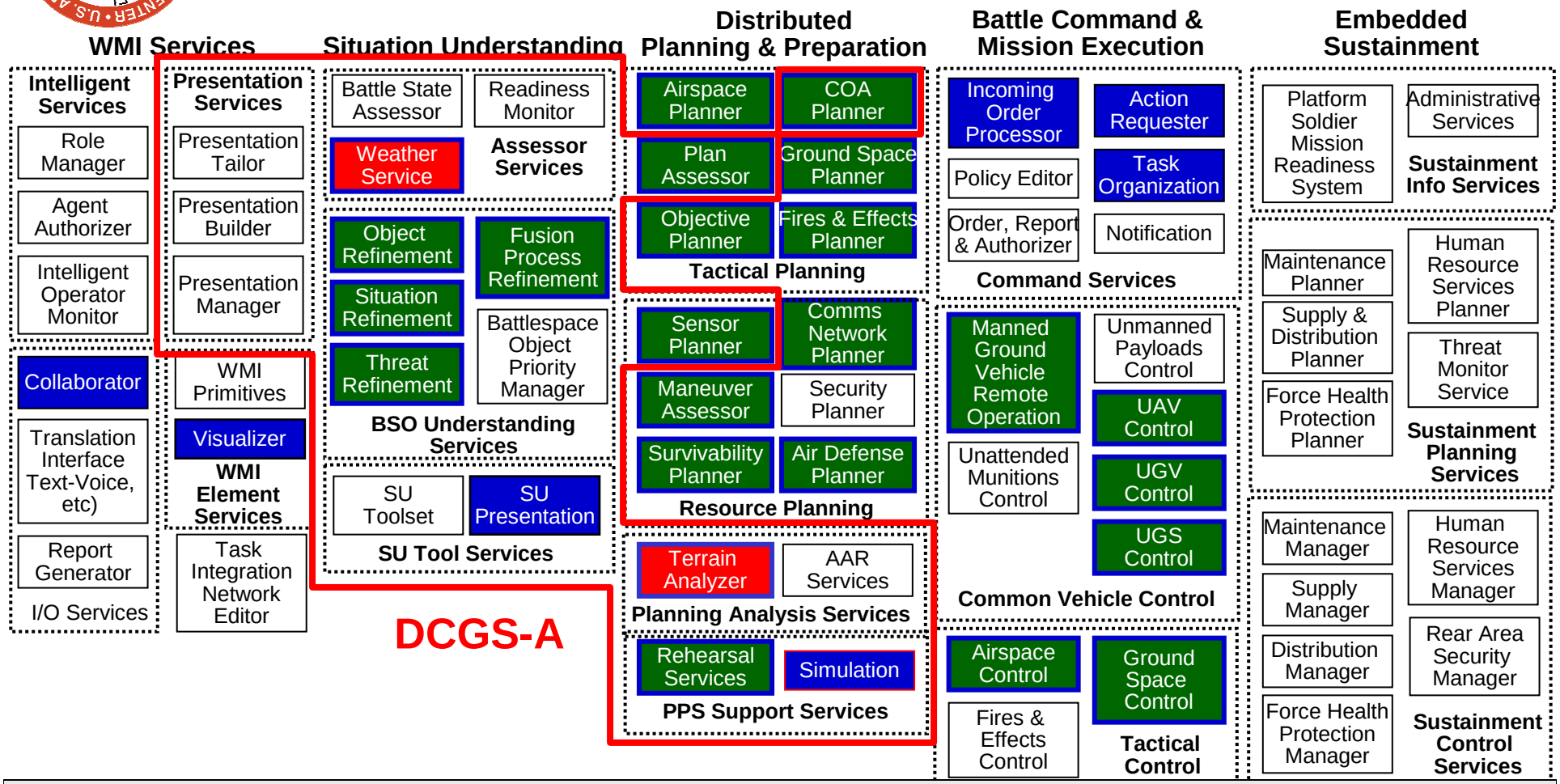
DTSS and IMETS requirements are consumed by DCGS-A

DCGS-A becomes the tangible requirement / CONOPS for BTRA-BC

Army expands its Aviation capability - UAVs

Battle Command- Net Centric (FCS)

(Geospatial and Atmospheric Information and Technology)



SoS COE - Net Centric Enterprise Services - Web Services - GIG

Interactive / Computational Info Services

Geo-based Decision Tools

GeoBML and JC3IEDM

DCGS-A is at BDE

FCS Battle Command Appliqué is on 470 Vehicles in the BDE

What about the Joint fight?

FCS Terrain Analyzer Requirements

Basic Terrain Analysis Functionality - OCOKA

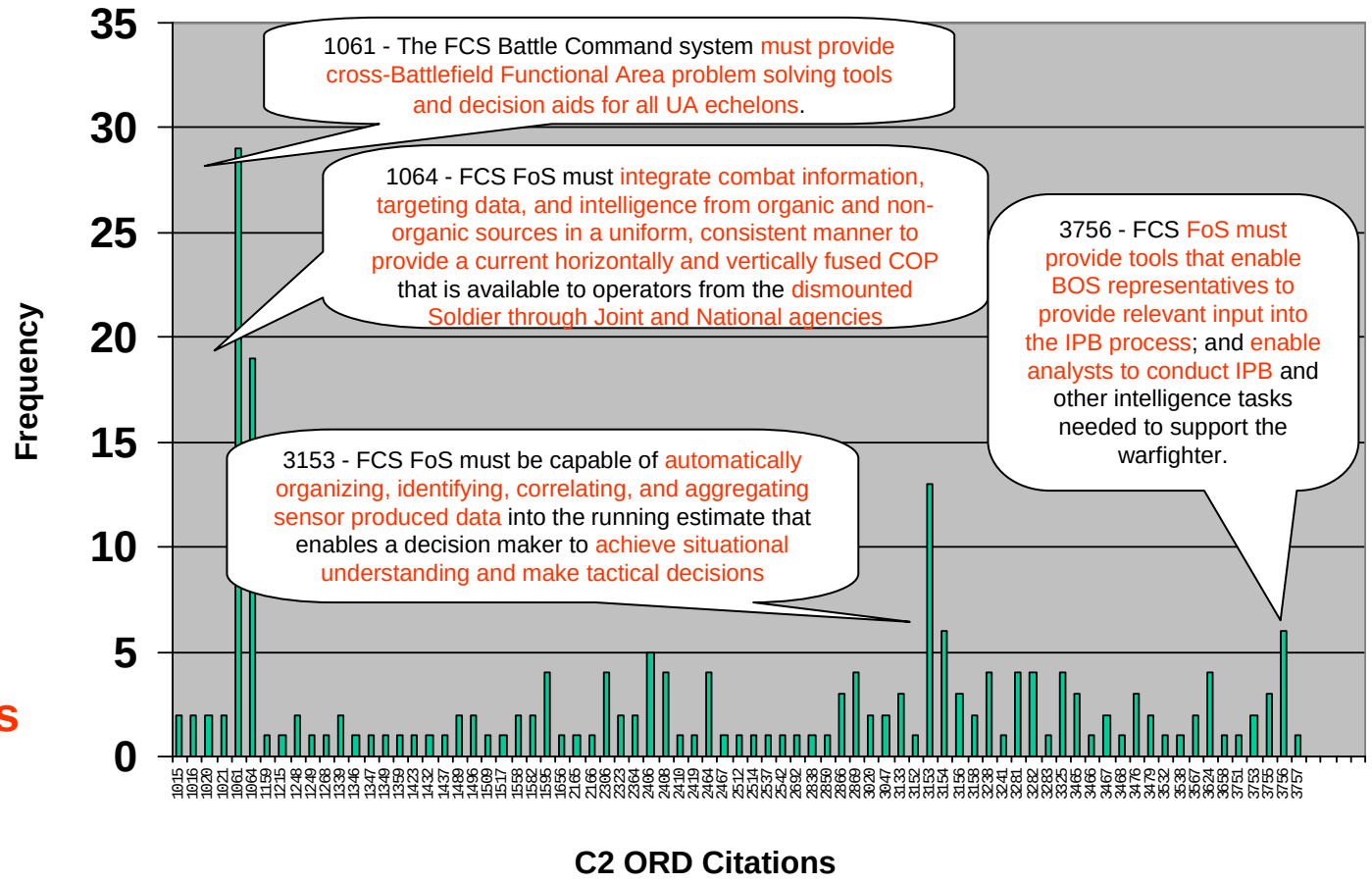
- **Terrain Data Importer**
  - NGA compatible base and Updates
- **Terrain Exposure Factor**
  - Cover and Concealment
- **Terrain Traversability**
  - Mobility
    - Obstacles
    - Weather
    - Cultural and Man-made features
- **Terrain Discernability**
  - Key Terrain and Site selection
    - Weather
- **Terrain Line of Sight**
  - LOS
    - Obstacles / physical impediments / DEM
    - Weather
    - Cultural and Man-made features
- **Terrain Intervisibility**
  - Observability
    - Weather
    - Cultural and Man-made features
- **Terrain Obstacles**
  - Type, size and location
- **Terrain Avoidance**
  - UAVs
- **Tactical Data Incorporation**
  - Threat and non-combatant location and terrain updates
- **Terrain Effects**
  - RF Propegation
- **Dynamic Terrain Analysis**
  - Weather
  - Explosives

FCS Derived Requirements – C2

207 ORD Citations Enabled by Terrain & Weather Information Integrated into C2 Processes

….. and Mission Application Services Defined by the LSI's Request for Proposals

Terrain and Weather Relationships to FCS ORD for C2



Terrain and Weather Info…. Ubiquitous Within the FCS Architecture

FCS Derived Requirements – ISR

168 ORD Citations Enabled by Terrain & Weather Information Integrated into ISR Processes

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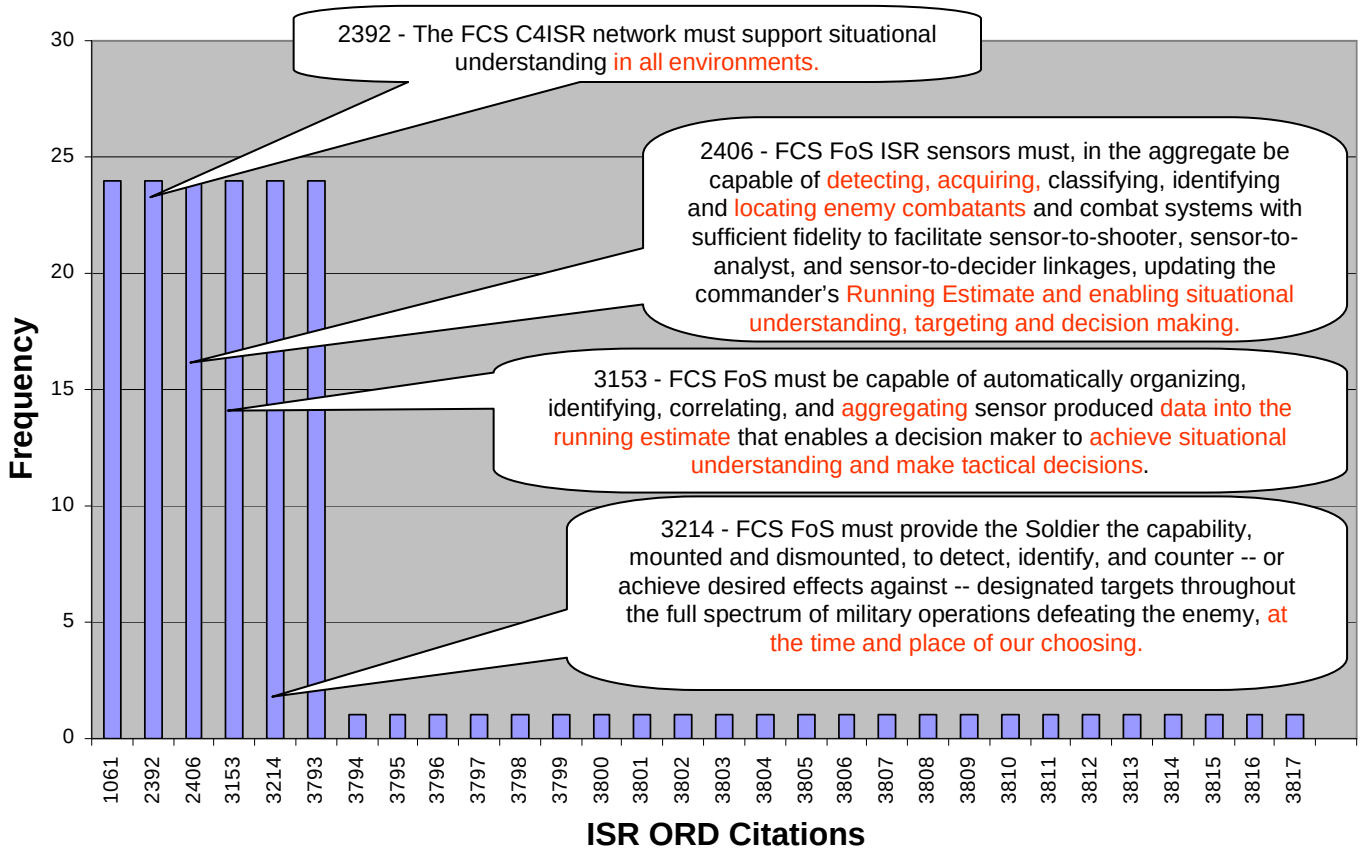
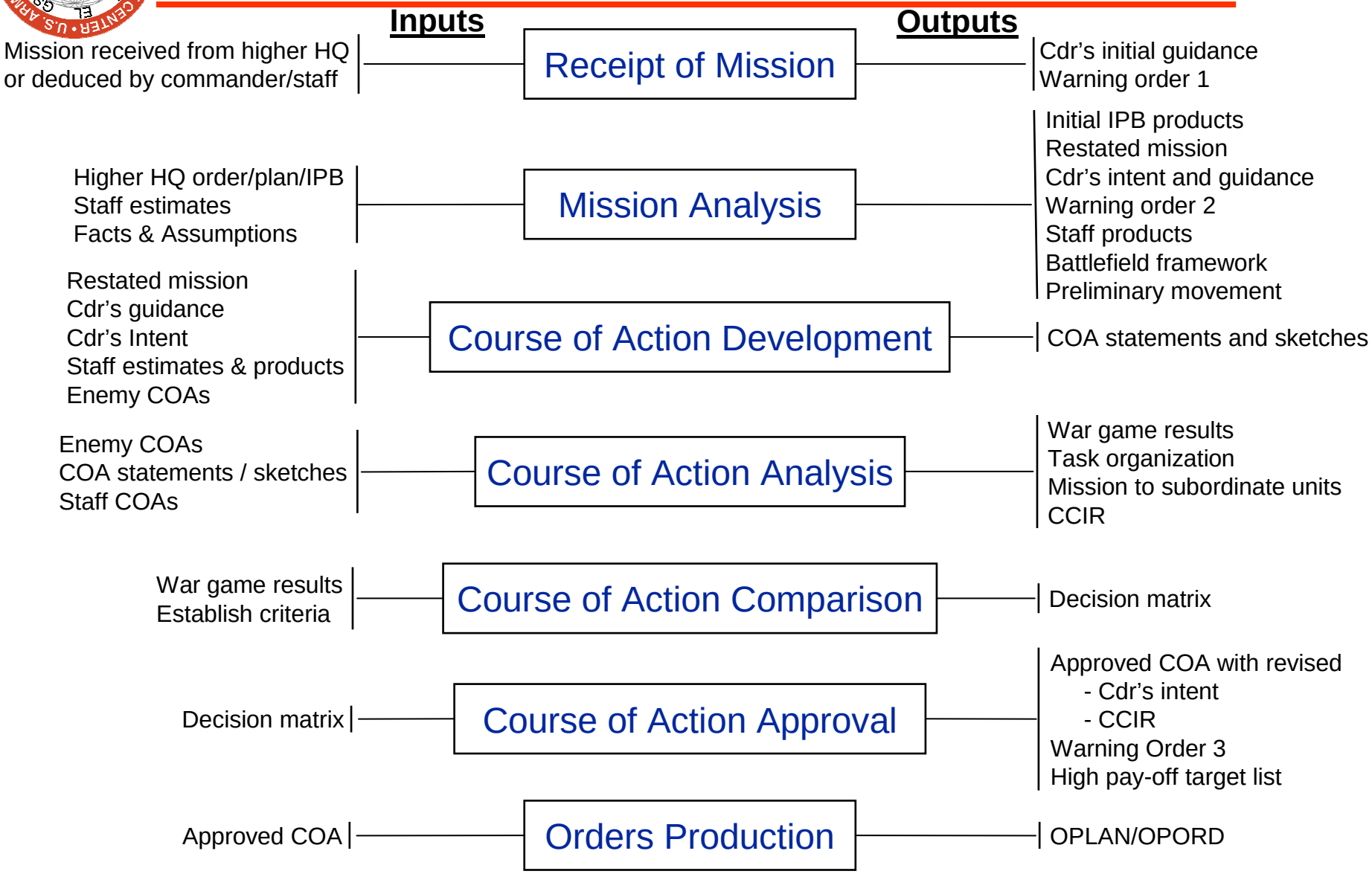
Terrain and Weather Relationships to FCS ORD for ISR



Military Decision Making Process (MDMP)
(FM 101-5)



Stable doctrinal process, trained to the force ….. system independent

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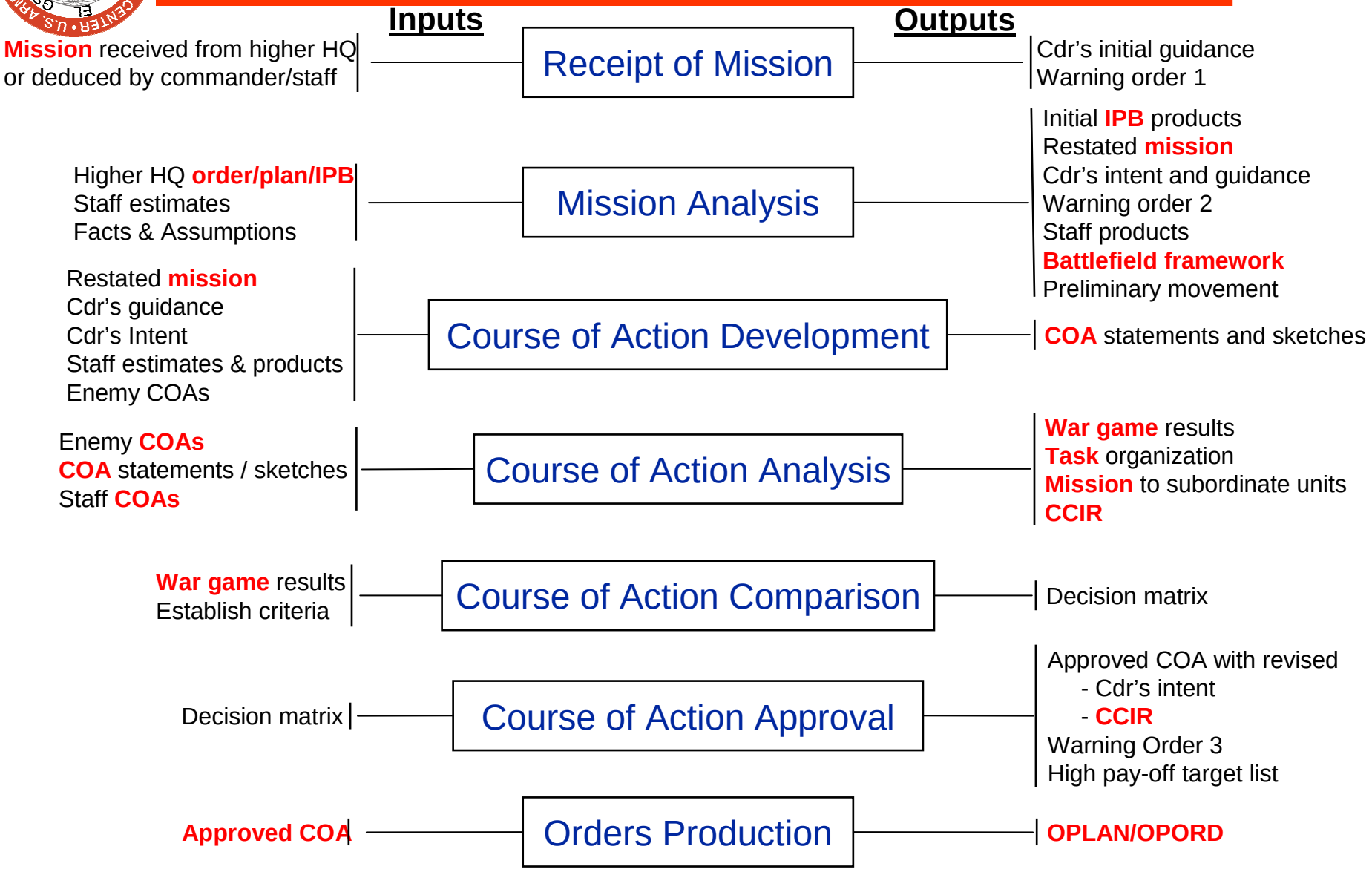
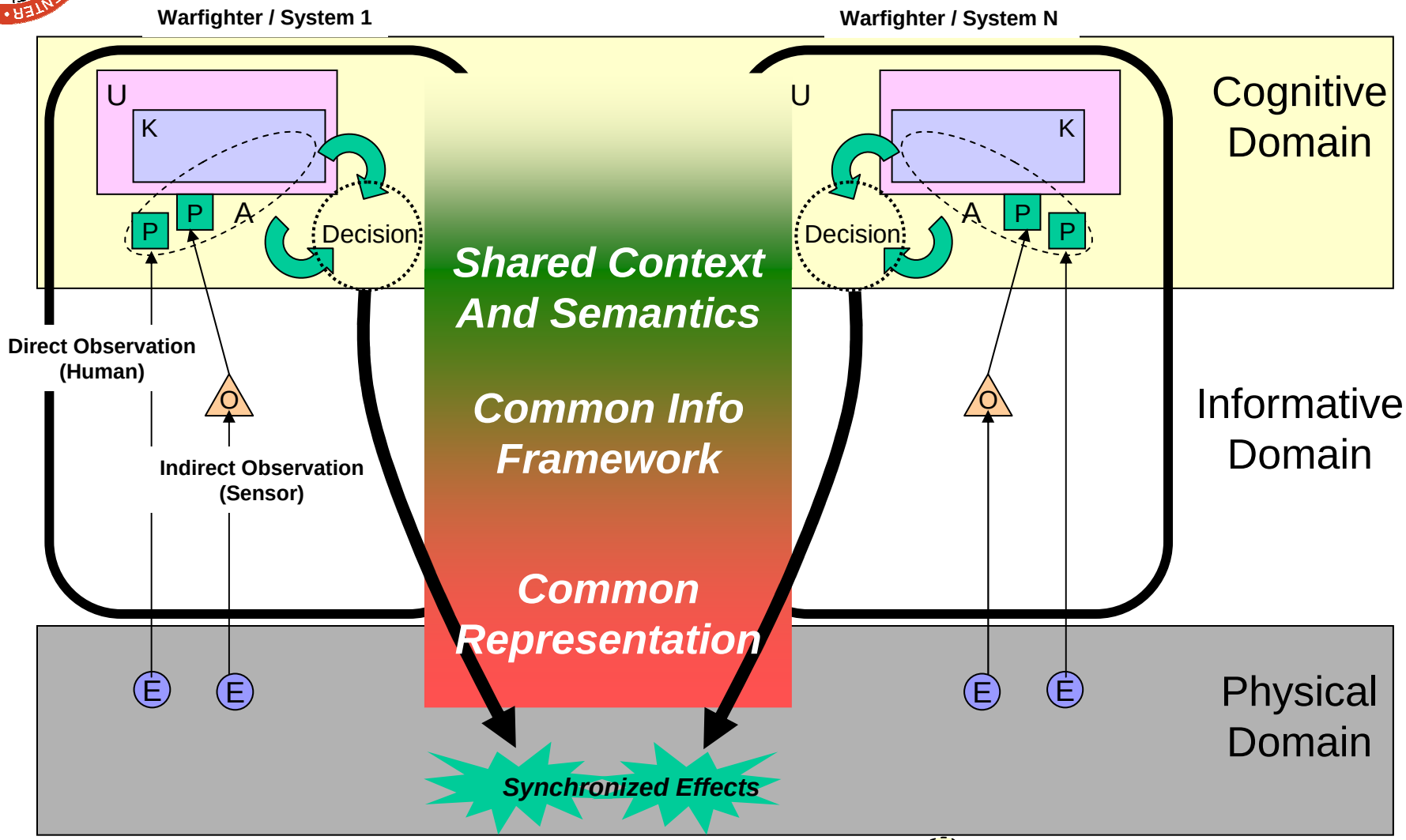


Stable doctrinal process, trained to the force ….. system independent

Distributed BC Considerations

- Bandwidth is finite…relatively
  - Consider the impact of actionable geospatial information products on the network
    - Minimize the size of information products and frequency of transmissions
    - Achieve the best ratio of information value to bandwidth
- Computation, storage and soldier expertise varies across the force
  - Consider the data, information, other support systems and soldier expertise that you require at the point of decision (e.g. force structure)
  - Consider the nature and quantity of interactions from the point
- Metcalf's Law
  - Real potential and value in each transaction with respect to the MDMP
    - Maximize OHIO…information should be ready to use in the MDMP
  - N-way transactions create the most value
    - Design to the broadest user set across Battle Command tasks / processes

Distributed BC Considerations
(Interoperability)



Adapted from: Alberts, Garksta and Stein, Network Centric Warfare, 1999, CCRP

Summary of Factors Influencing BTRA-BC Program

- **Battle Command - Battlefield Operating Systems**
  - No strong CONOPS……set of requirements from TRADOC
  - Army and Joint Programs of Record (PORs) with overlapping mission, process but competing operational and architectural objectives (ABCS……DCGS-A……FCS)
    - Geo-environmental is not central in any POR except DTSS and IMETS (DCGS-A)
    - Service Oriented Architectures ….. Web Services ….. Client - Server ….. Application Services
    - NGA's Commercial Joint Mapping Toolkit (C/JMTK) addresses Joint Geo-environmental functionality
  - Expansion of Army Aviation operations (UAV) and BC
    - Support to ground forces
- **MDMP**
  - Stable, trained process, independent of PORs
  - Founded upon mission, task, activity, COA and wargaming
- **Tenets of Network Centric Operations**
  - Interoperability is essential
    - Consistent representation of the physical environment and effects
    - Common Semantics and Framework for Information Sharing
  - Competition for bandwidth is increasing
    - Information abstraction
  - Increasing capability and decision making is pushed to lower echelons
    - Presentation and interaction with a diminishing force structure and staffing ….. must insure information value
    - Greater automation and decision tools

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  - Battlefield Operating System of Systems….. Battle Command
  - Decision Making Process….. MDMP
  - Distributed, networked force ….. comprised of ground and air assets

- ***Technical Objectives and Challenges:***
  - Automated Information Generation and Decision Tools
    - Utility within the MDMP process and the functions of Battle Command
    - Integration terrain, weather and atmospheric effects on tactics, platforms, systems and soldiers
    - Common Computational Representation
  - Interoperability
    - Syntactic, Lexical and Semantic
  - Operationally viable information architecture BDE and Below
    - Near-term (Components and Web Services) ….. CJMTK, DTSS and DCGS-A
    - Far Term (Application Servers) to empower platform level ….. FBCB2 and FCS

Technical Program Evolution

Platform Effects

Weather Analysis and Structural Organization

Atmospheric State and Sensor Effects

Sensor Effects

Terrain / Weather Temporal Effects at the Boundary Layer

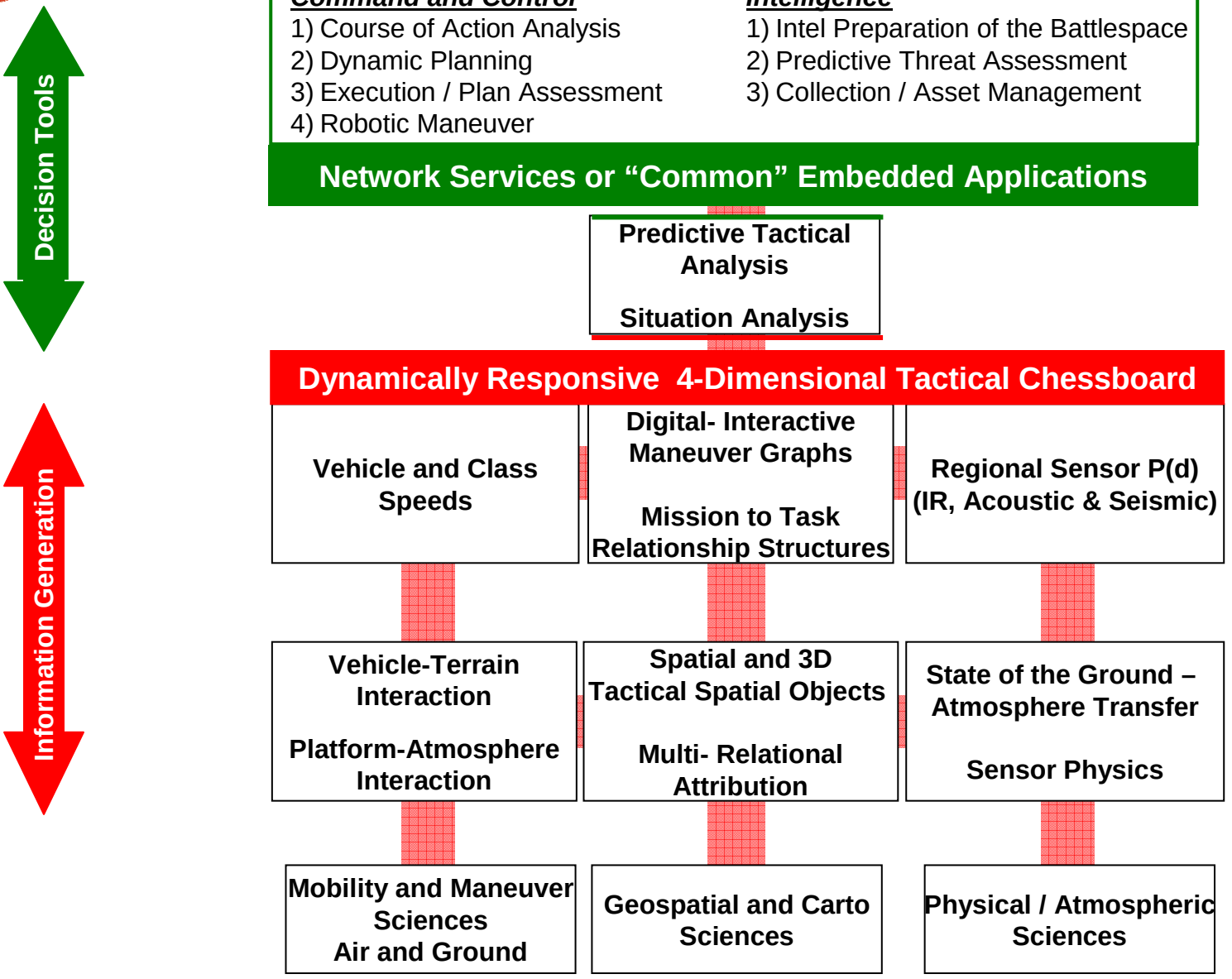
Terrain State and Mobility Effects

Terrain Analysis and Structural Organization

Spatial Organization (unit / task) Temporal Organization (unit / platform)

Information-Decision Tool Framework

(Is it a System?)



Current Spatial Objects for geoBML

Tier 1 Products (Terrain/Military Context)

- Natural Obstacles
- Concealment
- Fields of Fire
- Cross Country Movement
- Maneuver Network
- Mobility Corridors
- Chokepoints

Tier 2 products (Mission Context) /Tier 3 products (Planned)

- Avenues of approach
- Assembly Areas
- Engagement Areas
- Tier 2 Routes
- Battle Positions
- Attack positions
- Axis of Advance
- Indirect Fire Firing Position
- Assault Positions
- Attack by Fire Positions
- Drop Zones
- Helicopter Landing Zones

Interoperability

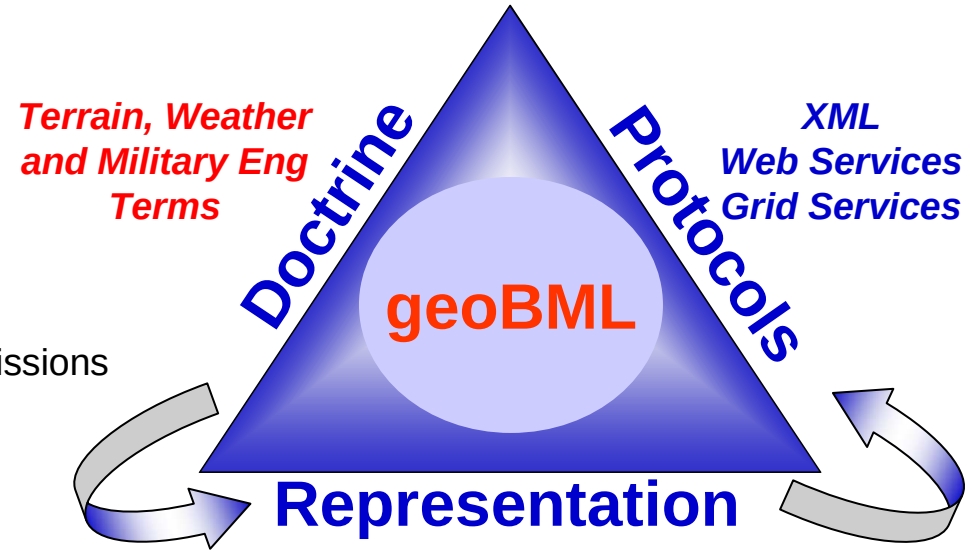
(geospatial Battle Management Language (geoBML))

geoBML is an Unambiguous Language

- Both domain specific and cross-cutting
- Defined by the role of actionable geo-information in the C2

Provides Unification…across

- Doctrine and terms
  - Explicit vocabulary and grammar
  - Specific context mapped to operations, missions and tasks
- Explicit Representation
  - Consistent extension to the C2IEDM
    - Standard framework and exchange model
  - Computational structure
  - Both necessary and sufficient for shared, common understanding
- Protocols
  - Explicit structure for transmission / sharing



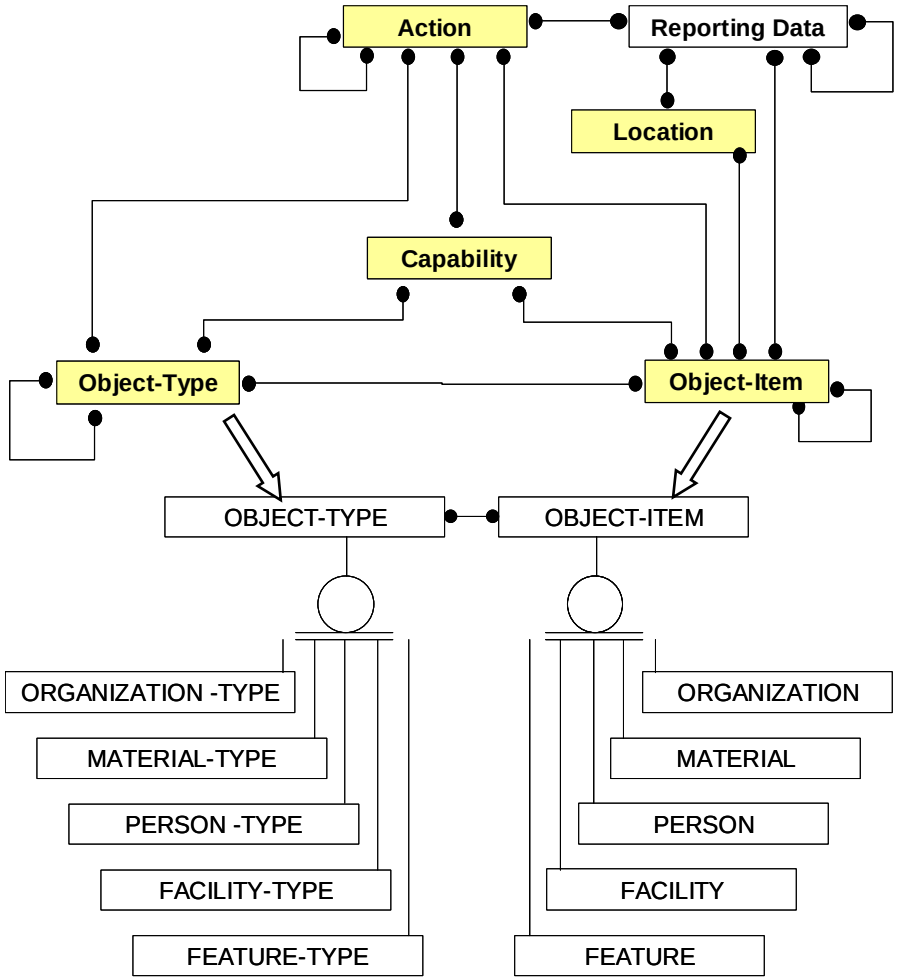
Geo-Environmental Extension to Command & Control Information Exchange Data Model (C3IEDM)

Explicit Computational Representation For Actionable Geospatial Information

Interoperability

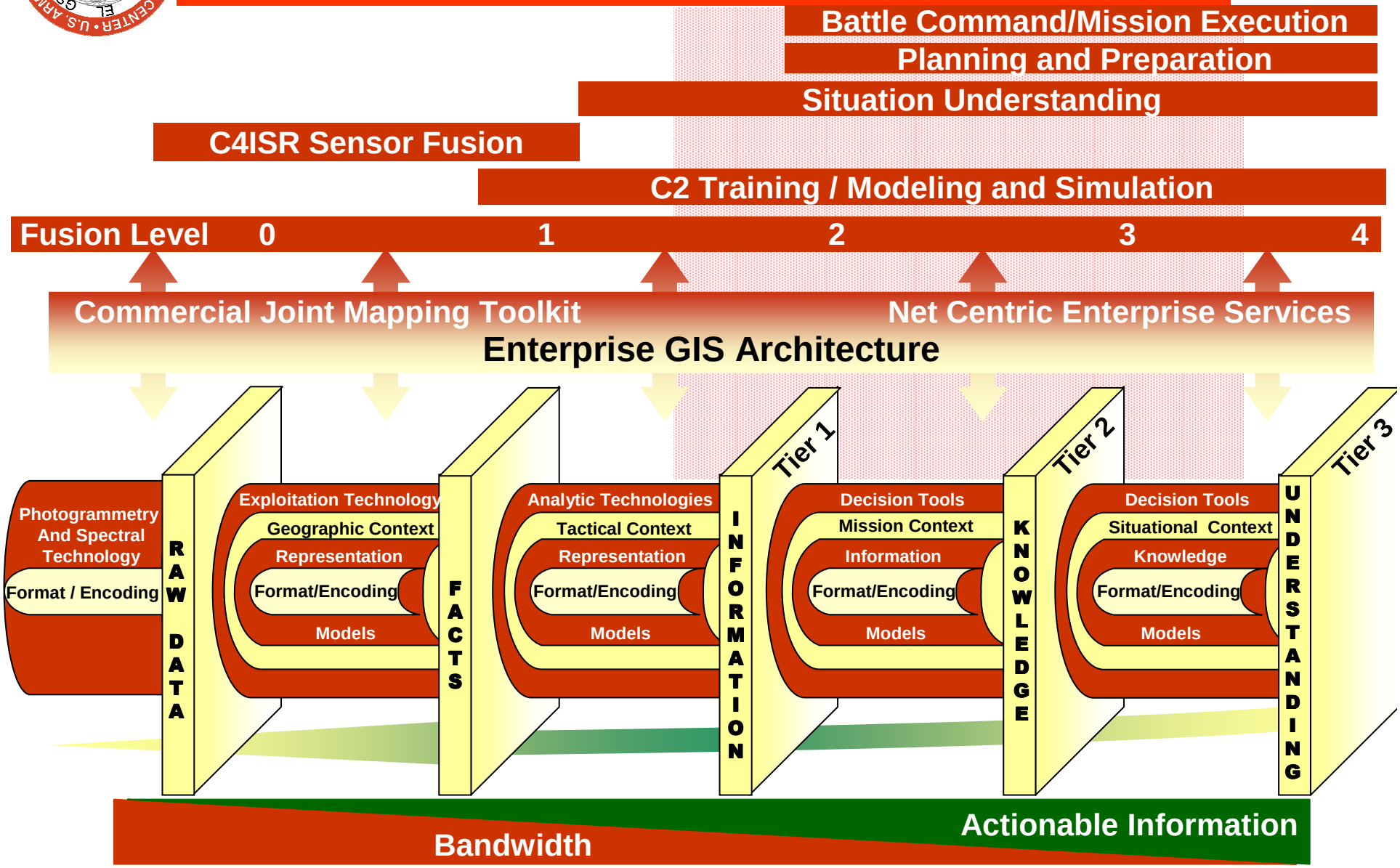
(Command & Control Information Exchange Data Model (JC3IEDM))

- **Provides Core C2 Semantics**
- **Comprehensive**
- **Very well documented**
  - Tables
  - Attributes
  - Relations
- **Allows for Extension**



Architectural Framework

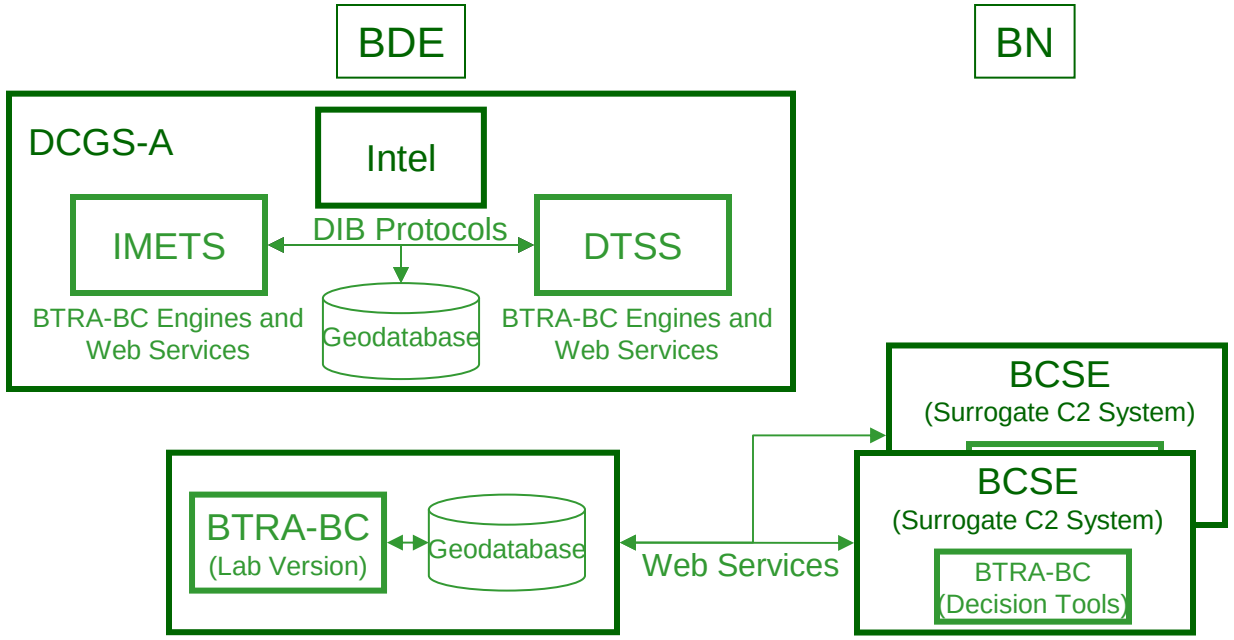
(Terrain and Weather)



Information Architecture

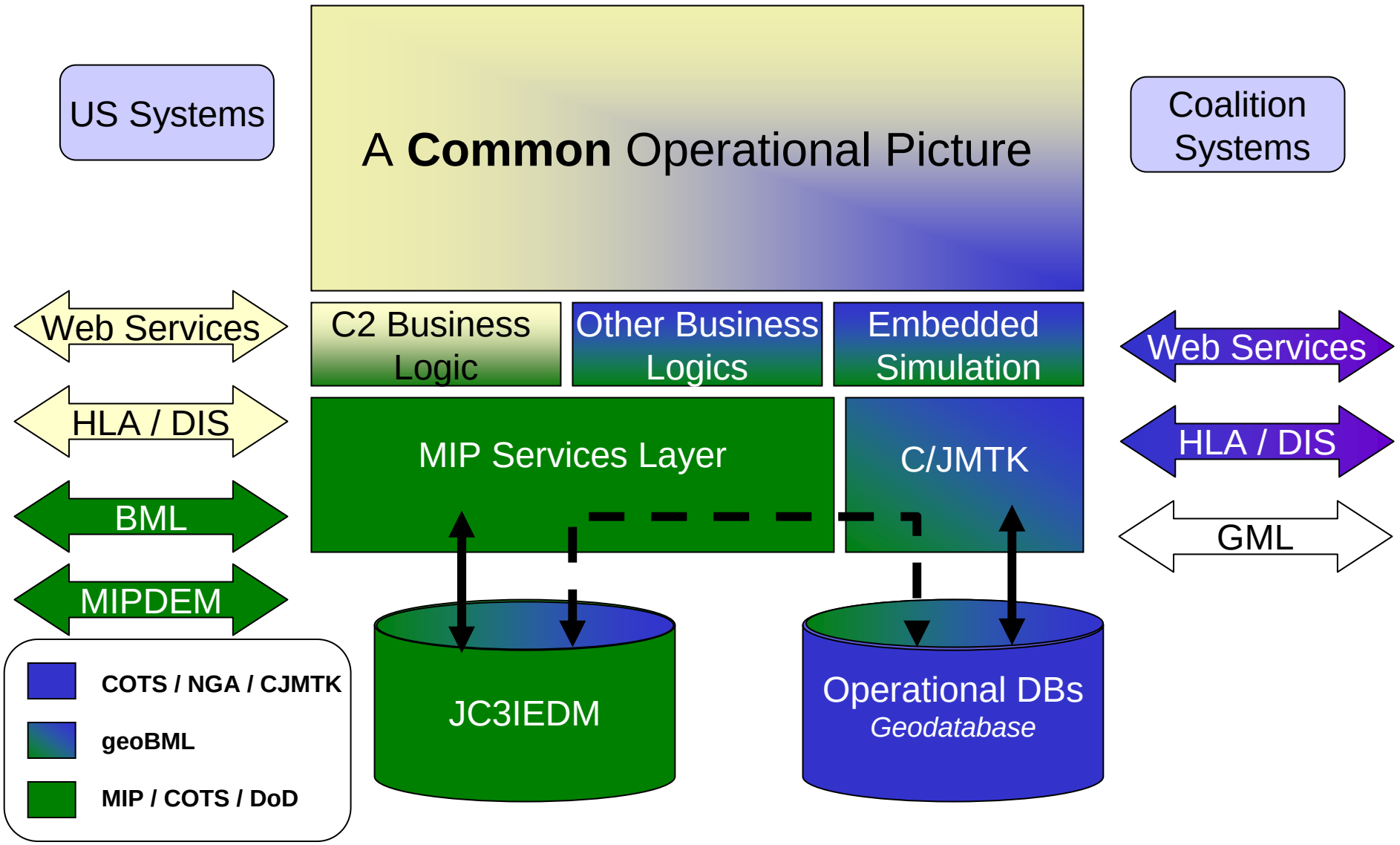
(FY07 - 08)

- **Engines and Application Services**
  - Individual Components - Information Generation and Decision Tools
  - Aggregated into Common Application Services where appropriate
- **System Wide Database Design**
  - Consistent I/O for flexible force structure implementation
  - Products and Services their products and attribution will be mapped to JC3IEDM
- **Web Services Implementation**
  - Most acceptable delivery for DTSS / DCGS-A and C/JMTK



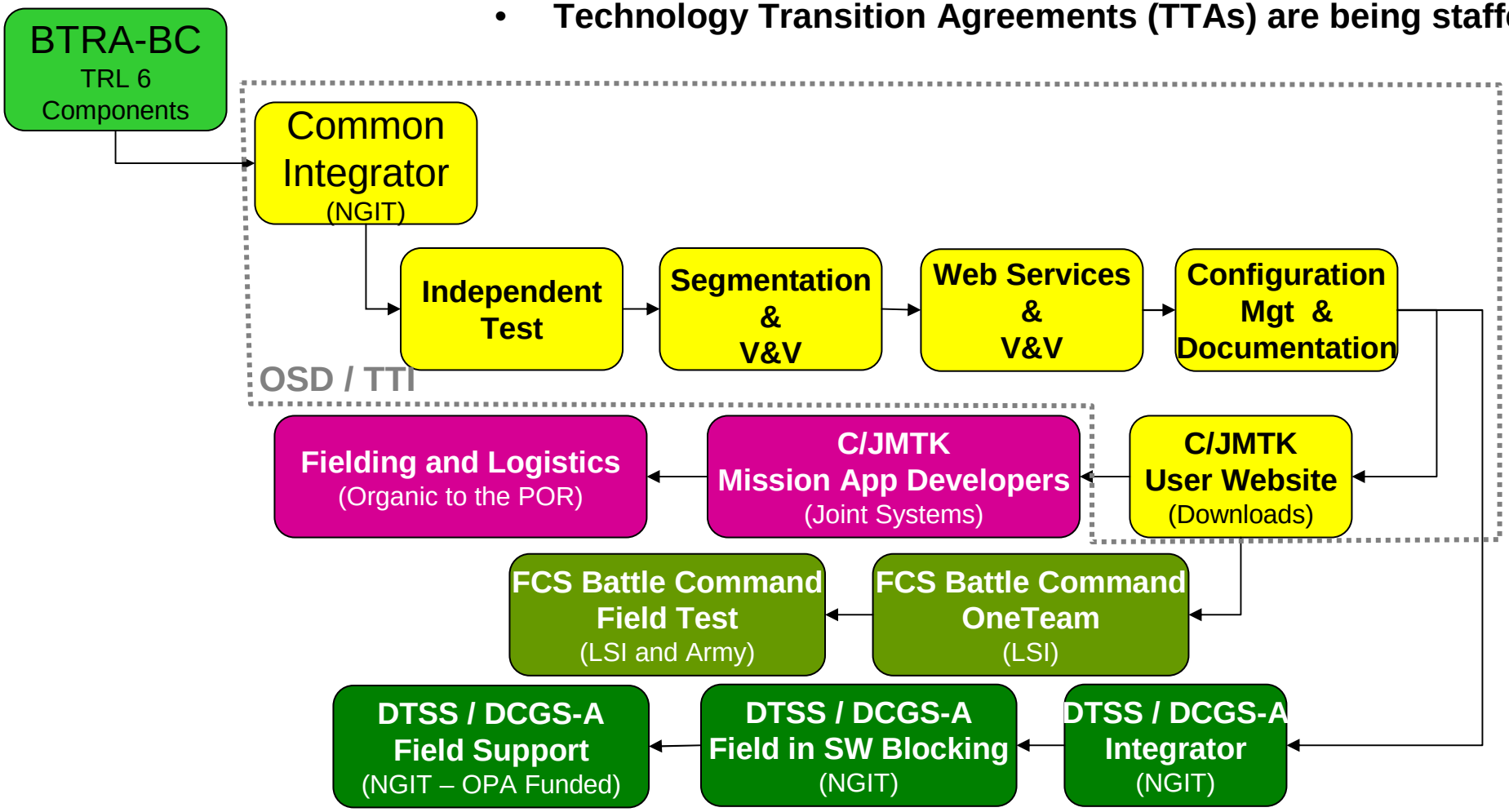
Information Architecture

(FY09 - 10)

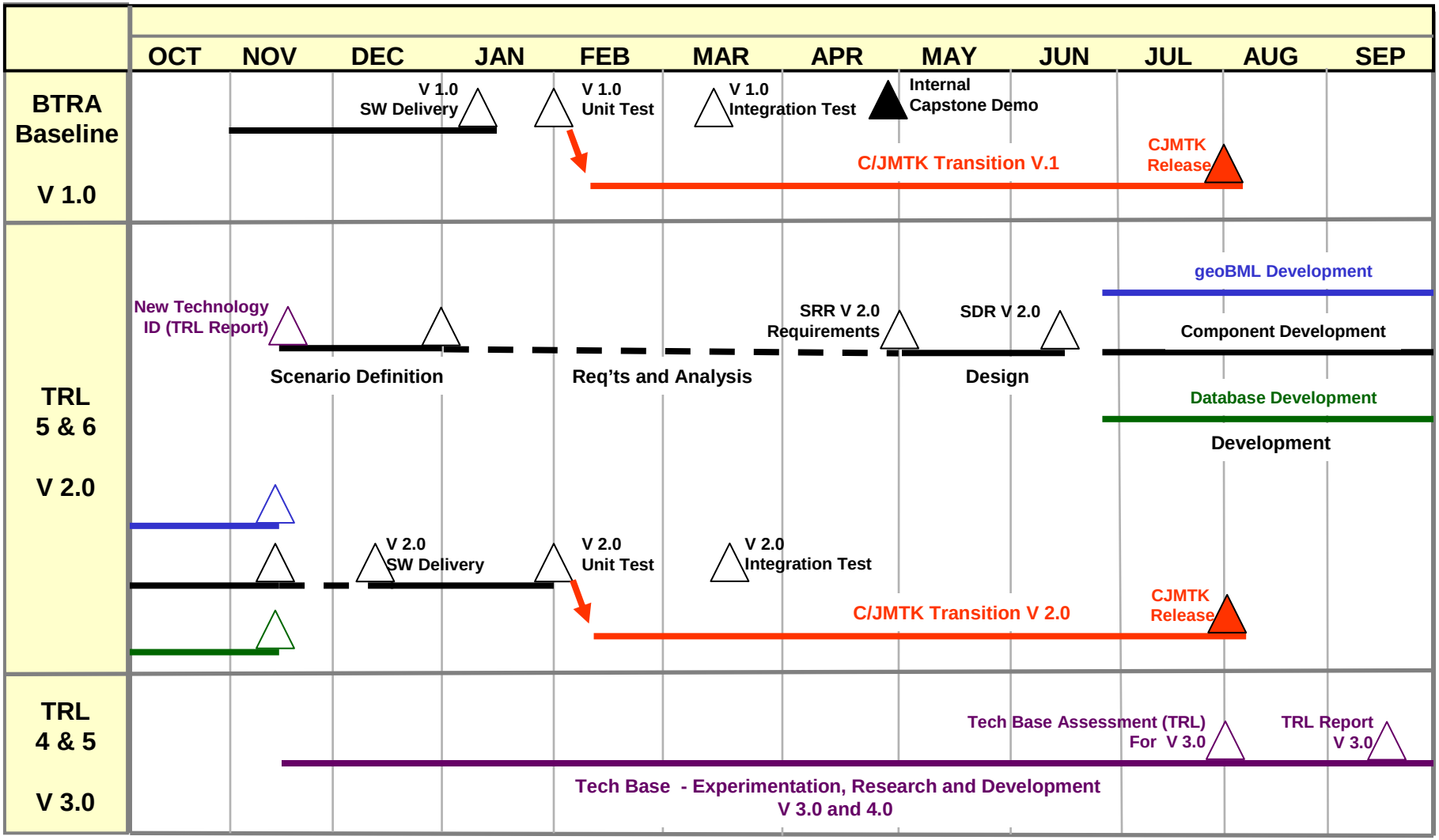


Transition Approach

- **Leverage common frameworks**
  - Technology
  - GIS base tools and CJMTK
  - System Integrators of the Programs of Record
- **Technology Transition Agreements (TTAs) are being staffed**



BTRA-BC Schedule
(Single Cycle Overview)



Performance via Process and Communication

We have a Strong Base

- **BTRA Team**
  - Consistent, actionable terrain/weather based information
    1. Terrain effectively organizes the battlefield with some tactical context (e.g. Mission or Task) and provides spatial discrimination
    2. Weather / terrain effects could generate actionable information with respect to mobility and sensor performance
    3. Computationally relate information structures from hypothesis 1 and 2
    4. Complexity of terrain based organization can support situation and threat analysis
    5. Shared awareness founded in information employing a common semantic is optimal
       - Human to human / Machine to human / Machine to Machine
    6. Terrain tools could be organized / configured in a distributed force structure
       - Service / Embedded
    7. Well engineered terrain information representation (s) could support a multitude of BFAs / BOSs
    8. Information representation(s) could be pushed to the edge of the force
    9. To what degree can automation can enable the force…. Where is the line

- **ARL**
  - IMETS insight and IWEDA Tactical Decision Aids
    1. Incredibly deep rule base
    2. Efficient algorithms

Closing Remarks

- **Simply stated, everyone associated with this program is outstanding ……. not very good ….. outstanding in their field**
  - My hope that these next 3 days will be an opportunity to
    - Renew existing professional relationships
    - Identify team members with similar and dissimilar interests
    - Come together for a common purpose based upon trust
- **Moving forward, we will face challenges and adversity**
  - Technical and/or competing approaches
  - Institutional cultures and individual personalities
  - Challenges imposed by geography
- **As a result, we are spending most of our time together ensuring that the process can overcome these challenges**
- **Process can not overcome the *Five Dysfunctions of a Team* (by Patrick Lencioni)**
  - Inattention to results
  - Fear of conflict
  - Absence of trust
  - Lack of Commitment
  - Avoidance of acccountability

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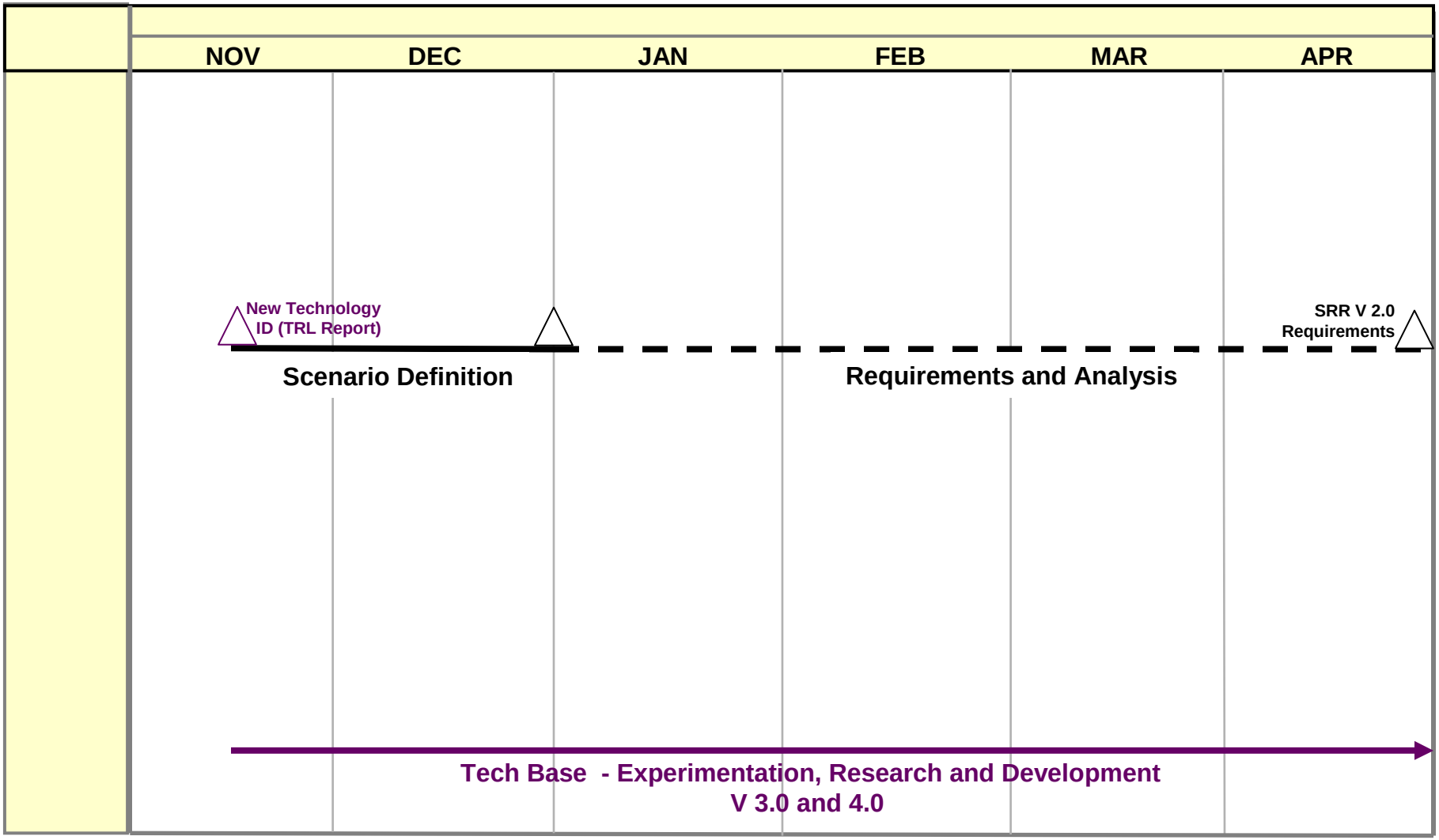
(Single Cycle Overview)



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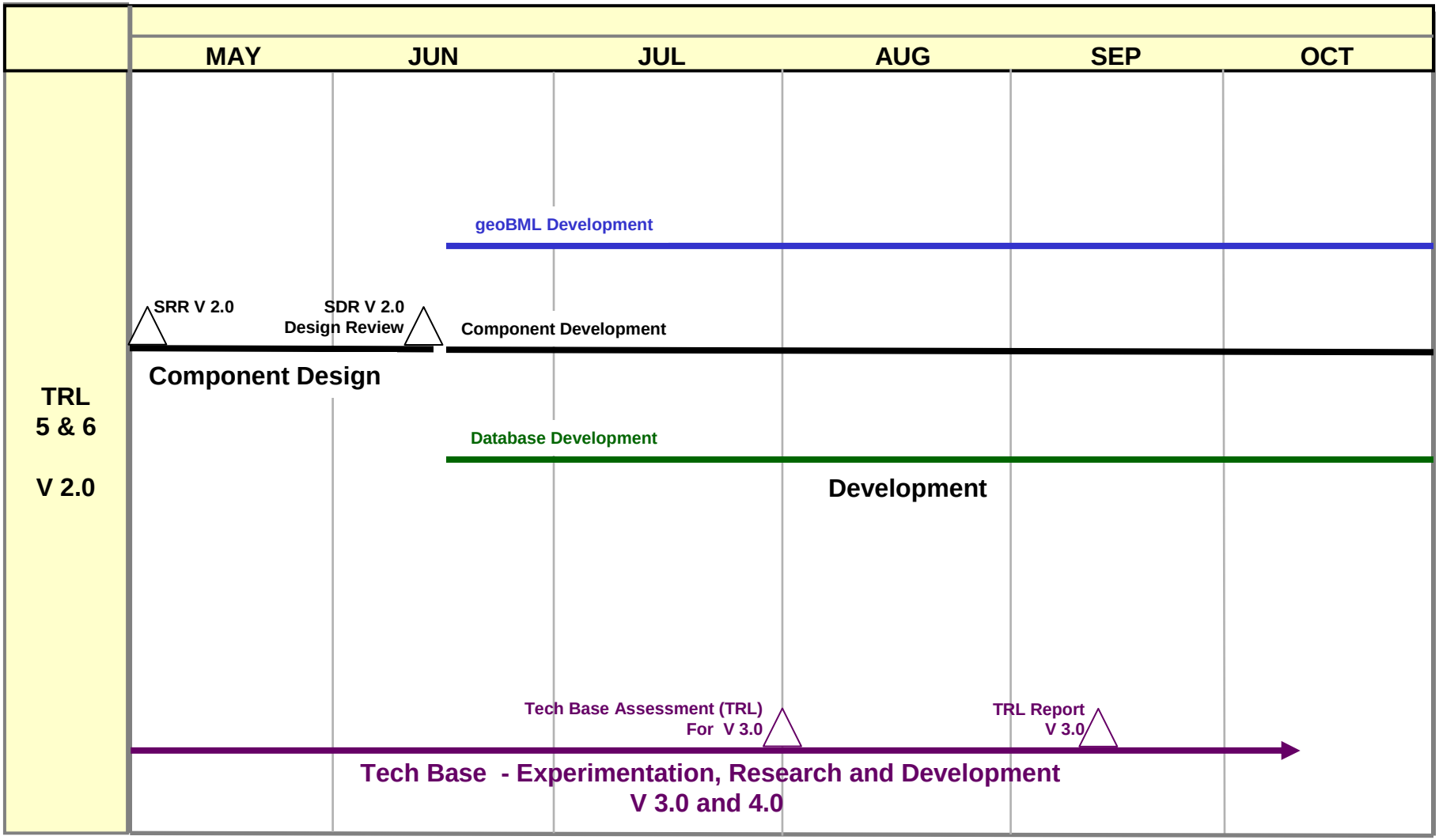

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